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BOOK REVIEW

Svetlozar T. Rachev, Young Shin Kim, Michele L. Bianchi, Frank J. Fabozzi: Financial models with Lévy processes and volatility clustering

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The authors, Rachev, Kim, Bianchi, and Fabozzi, of *Financial Models with Lévy Processes and Volatility Clustering* try to aggregate important parts of the massive body of literature on financial modeling, one of the major mathematical fields in finance, in a total of 394 pages. The importance of newer models arises not only as a consequence of the recent financial crisis and the failure of risk management; stochastic processes are also frequently used in asset pricing and many other financial areas.

The authors attempt to address the needs of both practitioners and academics by connecting theory with application: assistance in implementation and empirical examples on option pricing and portfolio management are provided, in addition to the theoretic background of the models they cover. The book could also serve as a readable reference and offers an explanation of basic probability theory to aid practitioners who might not have a strong mathematical background.

The book begins with a short sketch of the historic evolution of theoretical financial models that are mostly based on the assumption of an underlying normal distribution. Their drawbacks in real life, such as thin tails and non-skewedness, are discussed later and a suggestion for other probability distributions as a solution is given. The second chapter deals with basic probability theory, which, as mentioned is designed to either widen the targeted audience or help readers recall their knowledge about probability distributions and characteristic functions. The authors keep the focus on relevant theory only. The next chapter deals with stable distributions and modified stable distributions, serving as a foundation for the fourth chapter on continuous time processes with various innovation distributions. A reference to finance comes with the introduction to changes of measure in Chapter 5. Exponential Lévy models for equity

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index data and the efficiency of parameter estimation are presented in Chapter 6. In Chapter 7, out-of-sample performance for option pricing is presented. An introduction to random number generation, simulation, and Monte Carlo methods is found in Chapter 8. Multidimensionality is also covered: tail behavior of financial markets with principal component analysis is tested and multivariate non-normal portfolio formation with copula based dependence is discussed. As is appropriate for a book about volatility clustering, discrete GARCH-type models make an appearance. Chapter 11 provides out-of-sample tests on option prices with standard GARCH models. Chapter 12 deals with GARCH models having different error term distributions, and infinitely divisible GARCH models are covered in Chapter 13. The book closes with Monte Carlo simulation approaches to value European- and American-style options.

In my opinion, the book is appropriately structured and its straightforward language and equation style make it accessible to the reader. The notation is very acceptable and consistent; only very few designations are not in line with standard literature but these do not cause a problem.

The introduction and conclusion sections provided in nearly every chapter make the book easy to use as a reference; that is, it is easy for the reader to comprehend the relevance of the chapter content. As a cover-to-cover reader, I personally found the introduction, in which drawbacks are highlighted, very motivating for continuing to read. Additionally, the application to data and visualizations, such as plots and tables, are very helpful in understanding the complex material.

With respect to content, there is not much to criticize. To my mind, the topics are well chosen, the title is not misleading, and the book covers a great deal of actual, state-of-the-art research. A very slight bias toward the research area of the authors can be discerned. Fundamental mathematical knowledge is presented only to the extent necessary. Due to the number of topics and amount of research covered, one cannot expect derivations or proofs for all formulas, but all corresponding literature is referenced. There is no optimal tradeoff between mathematical formulation or rigor and its importance for application in finance: the balance is very subjective, depending on background and intent. To my mind, the degree of detail provided, especially for the mathematical foundations, is in some cases not suitable, but this slight criticism had very little impact on my overall opinion.

To sum it up, the book fulfills its expectations. It serves practitioners and academics very well; thus I can recommend it to a broad audience.